



Outboard Flap

Inboard Flap

Aeronautics

# Aircraft Landing Noise Reduction Liners

Two implementations of acoustic liners to reduce  
aircraft noise during landing

NASA Langley Research Center has developed two new implementations of acoustic liners for aircraft noise reduction whereby curved channels within tight spaces can be outfitted to provide noise reduction. The two implementations are flap side edge liners and landing gear door liners for airframe noise reduction. In these applications, the acoustic liner is designed primarily to reduce aircraft noise that occurs during landing, which will help aircraft comply with increasingly stringent airport noise restrictions.

## BENEFITS

- ➔ Does not add weight to the aircraft
- ➔ Has minimal impact on aerodynamic characteristics
- ➔ Allows for noise reduction in space-constrained areas
- ➔ Uses proven noise reduction designs
- ➔ Can be easily retrofitted in some areas of the aircraft

## APPLICATIONS

- ➔ Aircraft
- ➔ Wind turbines and tubomachinery in general
- ➔ Other noise abatement applications

technology solution



### THE TECHNOLOGY

**Flap Side Edge Liners for Airframe Noise Reduction.** In this implementation the flap side edge surface is perforated, and several internal channels of different lengths are created within the flap side edge volume. The channels act as organ pipe resonators, capturing sound at different frequencies. Channels could be filled with a material such as foam to tune the frequencies at which noise is absorbed. The configuration not only absorbs noise from the flap edge, but it also inhibits the process of noise generation by altering the boundary layer conditions at the flap edge surface. This concept can also be applied for the reduction of tip noise from rotating blades, or from any surface that produces significant lift with associated self-noise due to a tip vortex.

**Landing Gear Door Liners for Airframe Noise Reduction.** Similar to the flap side edge design, one surface of the landing gear door is porous. Interior to the door are chambers designed at different lengths to capture a broad spectrum of noise frequencies. These chambers can have bends of 30 to 90 degrees to optimize use of limited space within the door panel yet still provide long chambers to capture and dispel sound. This configuration, as the flap side edge surface liners above, also provides noise abatement in two ways: (1) direct absorption through the perforated holes into the chambers, and (2) changes to the boundary layer conditions. Gulfstream is a co-inventor on this implementation.



Landing gear door and flap side-edge liner close-ups

### PUBLICATIONS

Patent No: 8,695,915; 8,708,272



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